1. A method of characterizing a color imaging system, the method comprising:

obtaining first data indicative of output of the color imaging system;

processing the first data, to yield second data, according to a color appearance model that varies in accordance with neutrality of colors indicated by the first data.

2. The method of claim 1 wherein the color appearance model varies according to a white reference vector that is a weighted combination of a local white point of the color imaging system and a common white point, the white reference vector being weighted more to the local white point the more a color indicated by the first data is neutral and being weighted more to the common white point the more the indicated color is saturated.

3. The method of claim 2 wherein the color imaging system is an emissive system and processing the first data includes using a media white point as the local white point to implement absolute colorimetry.

4. The method of claim 1 wherein the color appearance model varies as a function of intensity of the color indicated by the first data.

5. The method of claim 4 wherein the color appearance model includes a luminance descriptor, and a pair of color descriptors that quantify relative amounts of red, green, yellow, and blue in a color indicated by the second data;

wherein the luminance descriptor varies as a function of Y, Y being one of tristimulus values X, Y, and Z of the color indicated by the first data; and

wherein the pair of color descriptors vary as functions of the neutrality of the color indicated by the first data.

6. The method of claim 5 wherein the luminance descriptor varies as a function of a Y-reference that is a weighted combination of a local white point Y-value and a common white point Y-value, the Y-reference being weighted more toward the local white point Y-value the closer the Y-value of the color indicated by the first data is to the local white point Y-value and being weighted more toward the common white point Y-value the more the Y-value of the color indicated by the first data and the local white point Y-value differ.

7. The method of claim 6 wherein the second data include values for L^*, a^*, and b^*; and

wherein

$L^* = 116 \times f(Y/Y_n'') - 16$

$Y_n'' = Y_{LW}(1 - sat(Y, Y_{LW})) + Y_{CW} * sat(Y, Y_{LW})$

$sat(Y, Y_{LW}) = 1.0 - (Y/Y_{LW})$

$a^* = 500(f(X/X_n') - f(Y/Y_n'))$

$b^* = 200(f(Y/Y_n') - f(Z/Z_n'))$

$f(\omega) = (\omega)^{1/3} \qquad \omega > 0.008856$

$f(\omega) = 7.787(\omega) + 16/116 \qquad \omega \leq 0.008856$

$X_n' = X_{LW}(1 - sat(C, C_{LW})) + X_{CW} * sat(C, C_{LW}))$

$Y_n' = Y_{LW}(1 - sat(C, C_{LW})) + Y_{CW} * sat(C, C_{LW}))$

$Z_n' = Z_{LW}(1 - sat(C, C_{LW})) + Z_{CW} * sat(C, C_{LW}))$

$C = (X, Y, Z)$

$C_{LW} = (X_{LW}, Y_{LW}, Z_{LW})$

$sat(C, C_{LW}) = (devX'Y'Z'/maxDev)^{\gamma}$

$maxDev = sqrt(6.0/9.0) * max(X', Y', Z')$

$devX'Y'Z' = sqrt((X' - avgX'Y'Z')^2 + (Y' - avgX'Y'Z')^2 + (Z' - avgX'Y'Z')^2)$

$avgX'Y'Z' = (X' + Y' + Z')/3.0$

$X' = X/X_{LW}$

$Y' = Y/Y_{LW}$

$Z' = Z/Z_{LW}$

where C_{LW} is a local white vector representing a local white point of the system, $C_{CW} = (X_{CW}, Y_{CW}, Z_{CW})$ is a common white vector for a common white point of the system, and γ is a variable for scaling the local white vector C_{LW} relative to the common white vector C_{CW}.

8. The method of claim 5 wherein the second data include values for L^*, a^*, and b^*;

wherein L^* is closer to a relative colorimetric value of L* than an absolute colorimetric value of L* the closer the value of Y is to a local white point value Y_{LW}; and

wherein a^* and b^* are closer to relative colorimetric values of a* and b*, respectively, than to absolute colorimetric values of a* and b*, respectively, the closer the indicated color is to neutral.

9. The method of claim 8 wherein

$L^* = (1.0 - sat\_L^*) * L^*_{rel} + sat\_L^* * L^*_{abs}$;

$a^* = (1.0 - sat\_a^*b^*) * a^*_{rel} + sat\_a^*b^* * a^*_{abs}$;

$b^* = (1.0 - sat\_a^*b^*) * b^*_{rel} + sat\_a^*b^* * b^*_{abs}$;

$sat\_L^* = 1.0 - (Y/Y_{LW})$;

$sat\_a^*b^* = (sqrt(a^{*2} + b^{*2}))/L^*$; and

wherein L^*_{rel}, a^*_{rel}, and b^*_{rel} are values of L*, a*, and b*, respectively, using relative colorimetry, and L^*_{abs},

a^*_{abs}, and b^*_{abs} are values of L^*, a^*, and b^*, respectively, using absolute colorimetry.

10. A computer program product residing on a computer readable medium, for characterizing a color imaging system, comprising instructions for causing a computer to:

obtain first data indicative of output of the color imaging system;

process the first data, to yield second data, according to a color appearance model that varies in accordance with neutrality of a color indicated by the first data.

11. The computer program product of claim 10 wherein the color appearance model varies according to a white reference vector that is a weighted combination of a local white point of the color imaging system and a common white point, the white reference vector being weighted more to the local white point the more a color indicated by the first data is neutral and being weighted more to the common white point the more the indicated color is saturated.

12. The computer program product of claim 11 wherein the color imaging system is an emissive system and the instructions for causing the computer to process the first data cause the computer to use a media white point as the local white point to implement absolute colorimetry.

13. The computer program product of claim 10 wherein the color appearance model varies as a function of intensity of the color indicated by the first data.

14. The computer program product of claim 13 wherein the color appearance model includes a luminance descriptor, and a pair of color descriptors that quantify relative amounts of red, green, yellow, and blue in a color indicated by the second data;

wherein the luminance descriptor varies as a function of Y, Y being one of tristimulus values X, Y, and Z of the color indicated by the first data; and

wherein the pair of color descriptors vary as functions of the neutrality of the color indicated by the first data.

15. The computer program product of claim 14 wherein the luminance descriptor varies as a function of a Y-reference that is a weighted combination of a local white point Y-value and a common white point Y-value, the Y-reference being weighted more toward the local white point Y-value the closer the Y-value of the color indicated by the first data is to the local white point Y-value and being weighted more toward the common white point Y-value the more the Y-value of the color indicated by the first data and the local white point Y-value differ.

16. The computer program product of claim 15 wherein the second data include values for L^*, a^*, and b^*; and

wherein

$$L^* = 116 \times f(Y/Y_n'') - 16$$

$$Y_n'' = Y_{LW}(1-\mathrm{sat}(Y,Y_{LW})) + Y_{CW} * \mathrm{sat}(Y,Y_{LW})$$

$$\mathrm{sat}(Y,Y_{LW}) = 1.0 - (Y/Y_{LW})$$

$$a^* = 500(f(X/X_n') - f(Y/Y_n'))$$

$$b^* = 200(f(Y/Y_n') - f(Z/Z_n'))$$

$$f(\omega) = (\omega)^{1/3} \qquad \omega > 0.008856$$

$$f(\omega)=7.787(\omega)+16/116 \qquad \omega\leq 0.008856$$

$$X_n'=X_{LW}(1-sat(C,C_{LW})) + X_{CW} * sat(C,C_{LW}))$$

$$Y_n'=Y_{LW}(1-sat(C,C_{LW})) + Y_{CW} * sat(C,C_{LW}))$$

$$Z_n'=Z_{LW}(1-sat(C,C_{LW})) + Z_{CW} * sat(C,C_{LW}))$$

$$C=(X,Y,Z)$$

$$C_{LW}=(X_{LW},Y_{LW},Z_{LW})$$

$$sat(C,C_{LW})=(devX'Y'Z'/maxDev)^{\gamma}$$

$$maxDev=sqrt(6.0/9.0) * max(X',Y',Z')$$

$$devX'Y'Z' = sqrt((X'-avgX'Y'Z')^2+(Y'-avgX'Y'Z')^2 +(Z'-avgX'Y'Z')^2)$$

$$avgX'Y'Z' = (X' + Y' + Z')/3.0$$

$$X'=X/X_{LW}$$

$$Y'=Y/Y_{LW}$$

$$Z'=Z/Z_{LW}$$

where C_{LW} is a local white vector representing a local white point of the system, $C_{CW}=(X_{CW},Y_{CW},Z_{CW})$ is a common white vector for a common white point of the system, and γ is a variable for scaling the local white vector C_{LW} relative to the common white vector C_{CW}.

17. A method of producing a color on a device, the method comprising:

obtaining first data associated with a first device and indicative of a first color;

determining second data related to stimulus data of the first device by a color appearance model that converts input data to output data using a white reference vector that varies in association with a neutrality of a color indicated by the input data;

actuating a second device according to the second data to produce a second color to approximate the first color.

18. The method of claim 17 wherein the white reference vector approaches a white point associated with first device as the color indicated by the input data approaches a neutral color.

19. The method of claim 18 wherein the color appearance model includes a luminance descriptor, and a pair of color descriptors that quantify relative amounts of red, green, yellow, and blue in a color indicated by the output data;

wherein the luminance descriptor varies as a function of Y, Y being one of tristimulus values X, Y, and Z of the color indicated by the first data; and

wherein the pair of color descriptors vary as functions of the neutrality of the color indicated by the first data.

20. The method of claim 17 wherein the first data are first device stimulus data of the first device and the second data are second device stimulus data of the second device, and determining the second data comprises mapping third data to fourth data, the third data being converted from the first data using the color appearance model and the fourth data being converted from the second data using the color appearance model.

21. A computer program product residing on a computer readable medium, for producing a color on a device, comprising instructions for causing a computer to:

obtain first data associated with a first device and indicative of a first color;

determine second data related to stimulus data of the first device by a color appearance model that converts

input data to output data using a white reference vector that varies in association with a neutrality of a color indicated by the input data;

actuate a second device according to the second data to produce a second color to approximate the first color.

22. The computer program product of claim 21 wherein the white reference vector approaches a white point, associated with each device whose data are used as the input data, as the color indicated by the input data approaches white or a neutral color.

23. The computer program product of claim 21 wherein the first data are first device stimulus data of the first device and the second data are second device stimulus data of the second device, and the instructions that cause the computer to determine the second data cause the computer to map third data to fourth data, the third data being converted from the first data using the color appearance model and the fourth data being converted from the second data using the color appearance model.

24. A method of producing a color with an emissive device using absolute colorimetry, the method comprising:

obtaining first data indicative of a first color;

determining second data related to the first data by a color appearance model that uses a white point of the emissive device as a white reference vector;

actuating the emissive device according to the second data to implement absolute colorimetry to produce a second color to approximate the first color.

25. The method of claim 24 wherein the white reference vector varies in association with neutrality of colors to be produced on the emissive device.

26. The method of claim 25 wherein the white reference vector varies from the white point of the emissive device when the second color is near white to a common white reference, different from the white point of the emissive device, when the second color departs from a near-white, neutral color.

27. A computer program product residing on a computer readable medium, for producing a color with an emissive device using absolute colorimetry, comprising instructions for causing a computer to:

obtain first data indicative of a first color;

determine second data related to the first data by a color appearance model that uses a white point of the emissive device as a white reference vector;

actuate the emissive device according to the second data to implement absolute colorimetry to produce a second color to approximate the first color.

28. A method of characterizing an emissive device for absolute colorimetry, the method comprising:

obtaining first data indicative of output of the emissive device;

converting the first data to second data using a color appearance model that uses a white point of the emissive device as a reference white vector;

providing the second data for use in absolute colorimetric color reproduction.

29. The method of claim 28 wherein converting the first data to second data further includes using, as the white reference vector, a composite white reference vector that is a weighted combination of the white point of the emissive device and a predetermined white point, the composite white reference vector being closer to the white point of the emissive device the closer a color indicated by the first data is to being neutral.

30. A computer program product residing on a computer readable medium, for characterizing an emissive device for absolute colorimetry, comprising instructions for causing a computer to:

obtain first data indicative of output of the emissive device;

convert the first data to second data using a color space that uses a white point of the emissive device as a reference white vector;

provide the second data for use in absolute colorimetric color reproduction.

31. A method of characterizing colors for reproduction between a first device and a second device, the method comprising:

normalizing first tristimulus values indicative of a color of the first device using local black point values;

transforming the normalized first tristimulus values to obtain color values indicative of modified cone responses of the human eye;

chromatically adapting the color values from a local condition to a reference condition; and

transforming the adapted color values to obtain second tristimulus values.

32. The method of claim 31 wherein a neutral axis of the local condition is mapped to a neutral axis of the reference condition.

33. The method of claim 31 wherein normalizing the first tristimulus values includes dividing by a difference between a local luminance value and a local black point luminance value.

34. The method of claim 33 wherein transforming the adapted color values includes multiplying the adapted color values by a reference white point luminance value divided by a difference between a local white point luminance value and the local black point luminance value.

35. The method of claim 31 wherein transforming the normalized first tristimulus values is performed using a Bradford transformation.

36. The method of claim 35 wherein normalizing the first tristimulus values and transforming the normalized first tristimulus values are performed according to

$$\begin{bmatrix} R_1 \\ G_1 \\ B_1 \end{bmatrix} = M_b \begin{bmatrix} (X_1-X_{1k})/(Y_1-Y_{1k}) \\ (Y_1-Y_{1k})/(Y_1-Y_{1k}) \\ (Z_1-Z_{1k})/(Y_1-Y_{1k}) \end{bmatrix}$$

where $[X_{1k}, Y_{1k}, Z_{1k}]$ is the local black point, X_1, Y_1, and Z_1 are the first tristimulus values,

$$M_b = \begin{bmatrix} 0.8951 & 0.2664 & -0.1614 \\ -0.7502 & 1.7135 & 0.0367 \\ 0.0389 & -0.0685 & 1.0296 \end{bmatrix},$$ and

R_1, G_1, and B_1 are the color values indicative of modified cone responses of the human eye.

37. The method of claim 36 wherein chromatically adapting the color values is performed according to

$$R_{ref} = (R_{rw}/R_{lw}) \times R_l$$
$$G_{ref} = (G_{rw}/G_{lw}) \times G_l$$
$$B_{ref} = \mathrm{Sign}[B_l] \times (B_{rw}/B_{lw}^{\beta}) \times |B_l|^{\beta}$$
$$\beta = (B_{lw}/B_{rw})^{0.0834}$$

where R_{rw}, G_{rw}, and B_{rw} are RGB values of a reference white point, R_{lw}, G_{lw}, and B_{lw} are RGB values of a local white point.

38. The method of claim 37 wherein transforming the adapted color values to second tristimulus values is performed according to

$$\begin{bmatrix} X_{ref} \\ Y_{ref} \\ Z_{ref} \end{bmatrix} = M_b^{-1} \begin{bmatrix} R_{ref} \times Y_l \times Y_{rw}/(Y_{lw} - Y_{lk}) \\ G_{ref} \times Y_l \times Y_{rw}/(Y_{lw} - Y_{lk}) \\ B_{ref} \times Y_l \times Y_{rw}/(Y_{lw} - Y_{lk}) \end{bmatrix}.$$

39. The method of claim 31 wherein transforming the normalized first tristimulus values is performed using a von Kries transformation.

40. The method of claim 39 wherein

$$\begin{bmatrix} X_{ref} \\ Y_{ref} \\ Z_{ref} \end{bmatrix} = M_v^{-1} \begin{bmatrix} L_{rw} & 0 & 0 \\ 0 & M_{rw} & 0 \\ 0 & 0 & S_{rw} \end{bmatrix} \begin{bmatrix} 1/(L_{lw}-L_{lk}) & 0 & 0 \\ 0 & 1/(M_{lw}-M_{lk}) & 0 \\ 0 & 0 & 1/(S_{lw}-S_{lk}) \end{bmatrix} M_v \begin{bmatrix} X_l \\ Y_l \\ Z_l \end{bmatrix}$$

where

$$M_v = \begin{bmatrix} 0.38791 & 0.68898 & -0.07868 \\ -0.22981 & 1.18340 & 0.04641 \\ 0 & 0 & 1.0 \end{bmatrix}$$

and where $[L_{rw}, M_{rw}, S_{rw}]$ are LMS (long, medium, and short wavelength band) values of the reference white, $[L_{lw}, M_{lw}, S_{lw}]$ are LMS values for local white, $[L_{lk}, M_{lk}, S_{lk}]$ are LMS values for local black, X_l, Y_l, and Z_l are the first tristimulus values, and X_{ref}, Y_{ref}, and Z_{ref} are the second tristimulus values.

41. The method of claim 31 wherein the first device is a print device and the second device is a print device, tristimulus values of a common illuminant are used as reference tristimulus white values for both print devices, media white tristimulus values of each print device are used as local tristimulus white values for both print devices, and Bradford-type adaptations are used for both print devices to implement media-relative colorimetry.

42. The method of claim 31 wherein the first device is a print device and the second device is a display device, tristimulus values of a reference illuminant are used as reference tristimulus white values, media white tristimulus values of the print device are used as local tristimulus white values for the print device, monitor white tristimulus values of the display device are used as local tristimulus values for the display device, and Bradford-type adaptations are used for both the first and second devices to implement media-relative colorimetry.

43. The method of claim 31 wherein the first device is a print device and the second device is a display device, tristimulus values of a reference illuminant are used as reference tristimulus white values, media white tristimulus values of the print device are used as local tristimulus white values, monitor white tristimulus values of the

display device are used as local tristimulus values for the display device, Bradford-type adaptation is used for the display device, and absolute CIE-Lab is used for the print device to implement absolute colorimetry.